DOCUMENT RESUME

ED 043 001 AL 002 533

AUTHOR	Slobin, Dan I.
TITLE	Suggested Universals in the Ontogenesis of Grammar.
INSTITUTION	California Univ., Berkeley. Language and Behavior Research Lab.
SPONS AGENCY	California Univ., Berkeley. Inst. of International Studies.; National Inst. of Mental Health (DHEW), Bethesda, Md.
REPORT NO	WP-32
PUB DATE	Apr 70
NOTE	20p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.10
DESCRIPTORS	*Child Language, Cognitive Development, *Grammar, Information Storage, Language Development, *Language Universals, Memory, *Mental Development, *Psycholinguistics, Semantics, Suprasegmentals, Syntax

ABSTRACT

This paper represents a preliminary attempt to determine universals of grammatical development in children. On the basis of language acquisition data, a limited number of findings are presented in the form of suggested developmental universals. These universals are grouped according to the psychological variables which may determine them, in the hope that it may someday be possible to predict facts of linguistic development from principles of mental development. The underlying assumption of this work is that the child brings certain operating principles to bear on the task of learning to speak. Some of these principles stem from his general cognitive development and some are a product of his psychological capacity to process and store information. Some of the latter principles may be specific to the manipulation of language but no particular claim is made here as to their innateness. Two broad aspects of mental development are considered. The first section of the paper deals with developing cognition of the social and material worlds (cognitive variables); the second section deals with the particular abilities of the human mind to deal with linguistic structures (language processing variables). The discussion is limited to the development of grammar. (Author/FWB)

EDO 43001

FB

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

SUGGESTED UNIVERSALS IN THE ONTOGENESIS OF GRAMMAR

Dan I. Slobin
University of California, Berkeley

AL 002 533

Working Paper No. 32
Language-Behavior Research Laboratory
April 1970

The Language-Behavior Research Laboratory
is supported by PHS Research Grant No. 1 R01 MH 18188-01
from the National Institute of Mental Health and a grant from the
Institute of International Studies, University of California, Berkeley.
This support is gratefully acknowledged.

9124

SUGGESTED UNIVERSALS IN THE ONTOGENESIS OF GRAMMAR

Dan I. Slobin

NOTE: What follows is a "working paper" in the true sense of the word. The ideas are still quite unformed, and I would be grateful for criticisms and suggestions. --Dan Slobin

This paper represents a preliminary attempt to determine universals of grammatical development in children. On the basis of language acquisition data, a limited number of findings are presented in the form of suggested developmental universals. These universals are grouped according to the psychological variables which may determine them, in the hope that we may someday be able to predict facts of linguistic development from principles of mental development. The assumption underlying the presentation is that the child brings certain operating principles to bear on the task of learning to speak. Some of these principles stem from his general cognitive development and some are a product of his psychological capacity to process and store information. Some of the latter principles may be specific to the manipulation of language, but no particular claim is made here as to their innateness. Universal characteristics of adult language are a result of the child's application of principles such as those enumerated below to speech occuring in the social and material settings of human communication. (Cf. Slobin, 1966b.)

Two broad aspects of mental development are considered. The first section of the paper deals with developing cognition of the social and material worlds, under the heading of cognitive variables. The second section deals with the particular abilities of the human mind to deal with linguistic structures, under the heading of language processing variables. The paper limits itself to the development of grammar.

Two sorts of developmental universals are proposed. The first, called "operating principles," are general heuristics or modes of operating with language. On the basis of these principles, taken along with data of linguistic development, a number of more specific predictions are made, called "universals." The list is far from exhaustive, but hopefully it will stimulate further development. The suggested universals are open to refinement and to empirical confirmation or disconfirmation in the light of data on the acquisition of various native languages.

Cognitive Variables

The function of grammar is to relate sounds to meanings. In order to acquire language, the child must attend both to speech and to the contexts in which speech occurs; that is, the child must be trying to understand what he hears. In so doing, he must make use of linguistic and cognitive discovery procedures, formulating internal structures capable of assimilating and relating incoming linguistic and non-linguistic data, and capable of realizing intentions as utterances. We do not know what goes on when a child attempts to assimilate linguistic input, however there is a good deal of evidence to suggest that the pacesetter in linguistic development is the child's cognitive growth, as opposed to an autonomous linguistic development which can then reflect back on cognition.

An important line of evidence comes from examining the development of utterances from both a formal and functional point of view. From studies which have attended to the supposed intended meanings of children's utterances, the following central operating principle emerges:

> Operating Principle 1: New forms first express old functions, and new functions are first expressed by old forms.

This principle is supported by the work of Piaget's school (cf. Furth, 1969) and by numerous studies of language development. The following examples are illustrative.

As Ingram (1968) has pointed out, many of the basic semantic relations expressed by two-word utterances can already be inferred in the child's use of one-word utterances. For example, "up," directed to mother, may imply that mother can be an agent; "wipe," uttered in the appropriate context, can imply that the child is an agent and that there is an object. Basic utterance modalities (interrogation, negation, desire, intensity) are also already present at this stage. It seems as if the first functions of two-word utterances may be only to make more explicit the functions already expressed by one-word utterances. That is, language may be used conservatively at first, and only later will the child realize the broader potentials inherent in the form of his utterances--probably as he begins to realize the underlying semantic possibilities which can be expressed by the forms he possesses.

Two-word utterances express a range of semantic relations which will later be formally marked. For example, Lois Bloom (1968), examining the use of noun-noun utterances in context, determined that five different semantic relations could be expressed by this structure: conjunction ("block, dolly"), attribution ("party hat"), genitive ("daddy hat"), subject-locative ("sweater chair"), and subject-object ("mommy book"). Clearly, the child's underlying semantic (cognitive) competence at this stage is more complex than the formal surface structures of his utterances. Here a single form (juxtaposition of two nouns) expresses a range of functions. When the appropriate forms enter (e.g. prepositions, inflections) they will serve old functions.

In Russian child speech (Slobin, 1966a, 1970a), when a new grammatical case enters it serves several functions at once. For example, in the language development of one Russian child (Gvozdev, 1949) when the instrumental case first appeared it was immediately used to indicate instrument of action, mutuality of action, and goal of action. The dative, on first emergence, indicated both indirect object of action and directed motion toward an individual. The child's rapid acquisition and differentiation of the inflections suggests that he must have already understood the semantic relations which they express.

Lois Bloom (1968) discovered a developmental sequence of negative expressions from (1) non-existence, to (2) rejection, to (3) denial. The first negative syntactic form was used to express non-existence. This form was then extended to rejection, and later to denial. An old form (the syntactic expression of non-existence) was then used to express new meanings (rejection and denial), resulting in a lack of syntactic distinction between the three categories. Bloom notes this as a general phenomenon, and states (p. 397): "The need to express a particular concept did not necessarily result in learning a different structure."

Richard Cromer (1968), in studying the development of temporal expression, found that old forms would first be used to express new meanings. For example, shortly before emergence of the perfect tense, his subjects attached "now" and "yet" to statements about the past, producing utterances performing the same semantic function as the perfect tense (e.g. "I didn't make the bed yet" "Now I closed it"). Such forms were soon replaced by the perfect.

The development of a new cognitive ability engenders a search for new means of expression, as frequently revealed in a child's idiosyncratic linguistic forms. Such forms antedate acquisition of the appropriate adult form. Development of auxiliaries and negatives in English provide many familiar examples, as the following from one of the writer's three-year-old subjects: "I must have getting weller and weller" [I must be getting better]. "Anyone isn't here." Wick Miller and Susan Ervin-Tripp, summarizing their longitudinal research, say (in preparation): "In all cases [of idiosyncratic rules], it appears that the non-standard rules developed because the child's semantic development had outstripped his formal grammatical development."

Given the primacy of cognitive development in setting the pace for linguistic development, it follows that many linguistic forms cannot appear until the child is capable of grasping their meaning. This is based on the most general and obvious operating principles:

Operating Principle 2: The semantic relations which a child can express and interpret in speech are limited by his level of cognitive development.

This simple operating principle, taken together with the hypothesis of universal stages of cognitive development, gives rise to a broad and far-reaching universal: The rate and order of development of semantic notions expressed by language are fairly constant across languages, regardless of the formal means of expression employed. A large number of specific predictions can be advanced on the basis of this expectation. Much of what is known about cognitive development could be formulated in terms of universals of language development. The following list of universals is only a suggestion of the direction in which such thinking could move.

Universal 2.1: Expressive utterances (performatives, demands) precede referential utterances.[1]

Universal 2.2: Expressions of location and direction are acquired earlier than expressions of time.

Universal 2.3: The order of development of the functions of negative utterances is: (1) non-existence (expected referent not present), (2) rejection (referent present but not desired), (3) denial (negation of actual or supposed assertion) (Bloom, 1968; McNeill and McNeill, 1968).

Universal 2.4: At early stages of development, the order of mention of events in an utterance matches their chronological order of occurrence (Clark, 1970; Cromer, 1968).

Universal 2.5: In sentence conjunction, coordinating conjunctions are acquired (used correctly) before subordinating and implicating conjunctions.

Universal 2.6: Utterances requiring time perspectives other than the present are late to develop[2]. (Cf. Cromer, 1968: a late-developing ability is the "ability to consider the relevance of another time to the time of the utterance.")

---

1. When universals are amply documented in the child language literature, no evidence or references are provided.

2. The notion "late to develop" is obviously in need of more precise definition.

Universal 2.7: Hypotheticals, counterfactuals, and conditionals are late to develop.

Universal 2.8: The course of development goes from gross classes to increasingly subdivided classes, and from general to finely delimited contextual constraints upon the occurrence of members of classes. I.e. more and more features are added to lexical items, and more and more rules are added for handling the co-occurrence restrictions on features. The acquisition of selectional constraints on the use of individual lexical items continues through childhood. (Cf. Chomsky, 1968; Menyuk, 1969.)

Universal 2.8 indicates that a form enters the child's linguistic system before all of its selectional constraints are realized. But note that a form never enters in a void; that is to say, something about its general use is correct. For example, conjunctions are not used as prepositions or prefixes. They enter as conjunctions; but in child English words such as "if," "so," and "because" are first more general conjunctions than they are in adult speech. Similarly, time words can be used in syntactically appropriate contexts before they are understood. The child can learn to put a word of a given class in position without fully understanding its content.

Since forms are not completely developed when first used, we are faced with a crucial question in the development of language and thought: Can the acquisition of linguistic forms influence the acquisition of their functions? Can the development of language affect the development of thought? Operating Principles 1 and 2 place serious restrictions upon a strong affirmative answer to this question, but the door is not closed to the possibility that formal aspects of language may accelerate or decelerate aspects of cognitive development. What is needed is careful cross-linguistic work on both language and cognitive development. Such research should be guided by a universal set of semantic notions which are expressed differently in different languages[3]. The criterion

---

3. A preliminary list might include all of the case relationships holding between verbs and nouns (cf. Fillmore, 1969), locative and directional relationships, possession, attribution, verbal notions (tense, aspect, conditionality, causality, reciprocity, etc.), modalities (negation, interrogation).

of emergence of a given semantic notion in development must be functional rather than formal. For example, a child should be credited with the possessive when he begins to frequently use constructions such as "daddy hat" (cf. Bloom, 1968) in contexts indicating the expression of a possessive relationship. The relevant data are order and rate of emergence of semantic notions across languages. In cases of discrepencies in rate of semantic (cognitive) development between languages, the formal means of expression of the notions should be examined as possible determinants. Such research, of course, requires full documentation of the contexts of the child's utterances in order to guess at his underlying intentions. The work of Lois Bloom, among others, has demonstrated the feasibility of this approach with young children.

Language Processing Variables

Some of the universals proposed under this heading relate to language-specific notions or abilities, while others reflect general limitations on the child's "computing space." The former are candidates for innate, language-specific factors in linguistic development. Although they do not appear especially profound at first glance, they may be quite significant in an evolutionary, cross-species perspective.

A number of such operating principles can be proposed. The earliest may be:

Operating Principle 3: Intonation and intensity of vocalization are of expressive significance.

Another crucial operating principle is present at a very early age:

Operating Principle 4: The flow of speech can be segmented.

This early discovery (or knowledge) is obviously a prerequisite for all language development. The child seems to have amazingly little difficulty in isolating words and meaningful parts of words. The perceptual apparatus is apparently well-tuned to detect repeatable sound sequence. This point need not be belabored.

Equally obvious is the fact that the child assumes that there is some point to talk, beyond emotional expression. Without expounding on the philosophical nuances of problems of meaning, reference, and communication, a principle of the following sort is clearly required:

> Operating Principle 5: Speech has non-expressive significance. (Words make reference.)

In order for the child to interpret utterances longer than one word he must assume that the meaning of an utterance is some sort of combination of the meanings of its component words.

Operating Principle 6: Words can be used in combination.

This operating principle may already be brought to bear in the interpretation of utterances while the child is at the one-word stage, but we lack clear evidence in this regard. Operating Principle 6 allows the child to form utterances longer than one word, and, given sentence programming limitations, a two-morpheme stage almost always ensues. On this basis of this operating principle, and the semantic and pragmatic functions of speech, the following universal can be stated:

> Universal 6.1: Beginning with the two-morpheme stage, the vocabulary can be divided into several large and fairly open classes of content morphemes (initially referring to concrete objects and actions on those objects) and a smaller number of operators or functors, combining with content morphemes in restricted and selective ways to particular relational concepts.

All further development, beyond the simplest combinations of two morphemes, depends on the all-important discovery of grammar, which can be expressed in the following operating principle:

Operating Principle 7: The meaning of an utterance is more than a combination of the meanings of its elements.[4]

Given the discovery of grammar, the child is faced with the task of determining what else is important in utterance besides word meanings and paralinguistic features. An early operating principle is almost certainly the following:

Operating Principle 8: The order of elements in an utterance is significant.

This operating principle has force on both reception and production of speech. In regard to production, the early force of this operating principle gives rise to the following universal:

Universal 8.1: If, in a given language, a particular semantic notion can be expressed either by word order or by inflection, the use of ordered uninflected words to express that notion precedes the use of inflection.

This universal is discussed at length elsewhere (Slobin, 1970a, 1970b). There is some evidence, though scanty, that Russian and Finnish children may develop some early order rules to express relations such as subject-verb, verb-object, and subject-verb-object before relying on the corresponding adult devices of inflection and relatively free word order.

On the receptive side, the following universal can be stated:

Universal 8.2: Sentences deviating from standard word order will be interpreted at early stages of development as if they were examples of standard word order.

Fraser, Bellugi, and Brown (1963) found that English-speaking preschoolers would interpret passive sentences as if the order of elements were subject-verb-object. That is, they applied the rule of standard order to sentences exhibiting a deviant order from the standard.

Roeper (1969) investigated attention paid by German children to word order and inflection. The standard word order for German imperatives is verb-indirect object-direct object (V-IO-DO), with inflected articles indicating

---

4. This discovery may not have been made by Washoe the chimpanzee --at least at the stage reported by Gardner and Gardner in 1969-- although the preceding operating principles do apply to Washoe.

the roles of IO and DO. When offered V-DO-IO sentences for imitation, there was a tendency to switch articles, placing the dative article on the first noun and the accusative on the second. Similarly, V-DO-IO sentences were frequently comprehended as if they were V-IO-DO. Thus in both imitation and comprehension many children tended to rely on word order over inflections as a guide to grammatical relations.

Limitations of processing space and storage contribute to an operating principle of far-reaching significance:

> Operating Principle 9: Rules applicable to larger classes are developed before rules relating to their subdivisions.

This operating principle can be referred to as the familiar principle of generality of rules in child speech. It is reflected in the following universal:

> Universal 9.1: There is a tendency to apply a linguistic rule to all relevant cases, ignoring exceptions; i.e. there is a tendency to overgeneralize and overregularize. The following stages of linguistic marking of a semantic notion are observed: (1) no marking, (2) appropriate marking in limited cases, (3) overgeneralizations of marking (often accompanied by redundant marking), (4) full adult system.

Numerous examples of this universal, and of Universals 10 and 11, can be found elsewhere (Slobin, 1970a). A classic example is the English past tense, as represented by the followng schematic sequence of stages of strong and weak forms in past tense contexts: (1) break, drop; (2) broke, drop; (3) breaked, dropped; (4) breakted, dropted; (5) broke, dropped.

Another operating principle works with Operating Principle 9 in determining the order in which classes are subdivided:

> Operating Principle 10: Rules relating to semantically defined classes take precedence over rules relating to formally defined classes.

Operating Principles 9 and 10 have the following implications for the development of function words and inflections:

> Universal 10.1: When selection of an appropriate inflection among a group of inflections performing the same semantic function is determined

by arbitrary formal criteria (e.g. phonological shape of stem, number of syllables in stem, arbitrary gender of stem), the child initially tends to use a single form in all environments, ignoring formal selection restrictions.

A number of corrollaries can be derived from Universal 10.1, such as the following:

Universal 10.1: In languages requiring case and gender agreement between adjective and noun, case agreement is acquired before gender agreement.

For example, Russian requires that the instrumental inflection attached to a noun be chosen on the basis of the gender of the noun and, in some instances, on the basis of phonological characteristics of the noun. The Russian child, however, selects a single salient instrumental inflection and suffixes it to all nouns to express the instrumental case (Slobin, 1966a, 1970a).

If such selections are looked upon as errors, the following universal is appropriate:

Universal 10.1a: Errors in choice of functor are always within the given functor class and subcategory.

For example, although the Russian child uses an instrumental noun inflection which fails to agree with the noun in gender, he does not express the notion of the instrumental case by means of a dative inflection, a verb-tense inflection, etc. Similarly, English-speaking children at first fail to appropriately subdivide prepositions according to their semantic functions, but do not confuse prepositions with conjunctions or other parts of speech.

Another operating principle is of relevance to the development of inflections:

Operating Principle 11: There is a preference for clear acoustic marking of functors.

Children may even make functors more clearly marked acoustically than they are in adult speech. Levina has noted that for Russian children "clarity and accuracy of pronunciation appear first of all in the inflections.

At the same time the word stem continues to sound inarticulate" (quoted by Leont'yev, 1965, p. 101).

This operating principle gives rise to the following universals:

Universal 11.1: A child will begin to mark a semantic notion earlier if its morphological realization is more salient acoustically.[5]

Bilingual children provide a useful control in regard to Universal 11.1. For example, Mikeš (1967), in a longitudinal study of Hungarian-Serbo-Croatian bilingual children, reports earlier acquisition of the Serbo-Croatian accusative inflection (-u) than the corresponding Hungarian inflection (-t).

Universal 11.2: There is a preference not to mark a semantic category by Ø ("zero morpheme"). If a category is sometimes marked by Ø and sometimes by some overt phonological form, the latter will, at some stage, also replace the Ø.

The Russian noun singular accusative is marked by Ø for masculine non-human and neuter nouns. Such nouns are first marked with the acoustically salient feminine accusative (-u) by Russian children (Slobin, 1966a, 1970a).

Universal 11.3: If in an inflectional system there are homonymous forms, those forms will tend not to be the earliest inflections acquired by the child. I.e. the child tends to select phonologically unique forms, when available, as the first realization of inflections.

The first noun instrumental inflection used by Russian children is the masculine and neuter -om, rather than the more frequent feminine -oy (Slobin, 1966a, 1970a). The suffix -om has only one homonym (masculine and neuter locative adjective inflection), while -oy represents five homonymous inflections.

Universal 11.4: When a child first controls a full form of a linguistic entity which can undergo contraction or ellipsis, ellipses or contractions of such entities tend to be absent.

Ursula Bellugi-Klima (1967) has noted the clear enunciation of "I will"--even in imitations of sentences containing "I'll"--at a developmental stage at which special attention is paid to the auxiliary system.

---

5. This notion requires more precise definition.

Another operating principle is of great significance to the order of development of linguistic rules:

Operating Principle 12: There is a tendency to preserve the internal structure of linguistic units. (Or, negatively stated: there is a preference to avoid interruption or rearrangement of linguistic units.)

Considering the word as a linguistic unit, this operating principle implies:

Universal 12.1: Prefixes and suffixes are acquired earlier than infixes.

There is no available evidence in regard to Universal 12.1. More precisely, this universal predicts that if a language uses both external affixes (prefixes and/or suffixes) and infixes, the latter will be slower to develop.

Operating Principle 12 has several important implications for syntactic development. Paula Menyuk expresses the underlying principle in the following terms (1969, p. 72): "The first step in the acquisition of operations for the generation of various sentence types may... be conjunction of an element to a sentence with no operations on the underlying sentence but with some restrictions involved." There are two aspects to this principle: preservation of internal structure (cf. Universal 12.2) and sentence-external attachment of elements (cf. Universal 12.3).

Universal 12.2: Structures requiring permutation or separation of elements will first appear in non-permuted or non-separated form.

An example in regard to separation is offered by the development of verb-particle constructions in English, where the obligatory separation of verb and particle by a pronominal object is often not observed in early child speech (e.g. "I called up him"). A familiar example in regard to permutation can be seen in early lack of inversion in the development of English questions (e.g. "I can go?" "Where I can put it?").

The latter example also shows external attachment of an element ("where"), leaving the internal sentence structure unchanged. This phenomenon can be somewhat loosely formulated in terms of the following universal:

Universal 12.3: There is a tendency to preserve the structure of the sentence as a closed entity, reflected in a development from sentence-external placement of various linguistic forms to their movement within the sentence.

Several examples can be offered from English (Bellugi-Klima, 1967; Menyuk, 1969). Early negative forms are attached to primitive sentences ("No do this"), later moving within the sentence ("I no do this" and, with auxiliary/modal development, "I can't do this"). Later in childhood it is observed that sentence-final relative clauses ("The man went home who was sick") are earlier to develop than embedded relative clauses ("The man who was sick went home"). (Note the "décalage," familiar in Piagetian accounts of cognitve growth.) Universal 12.3 is applied repeatedly in the course of development. In the earlier example, it is the negative element which moves into the sentence. Much later, when sentence embedding takes place, center embedding is later to develop than right or left embedding. Cyclic or repeated application of operational principles may be a general functional aspect of linguistic development.)

The processing variables considered thus far have been more or less specific to language, and may represent species-specific mental capacities peculiar to man as a language-using animal[6]. A number of the universals, however, are also influenced by general psychological variables involved in short-term information processing and long-term storage. These psychological variables are introduced in the following two (loosely-defined) operating principles.

Operating Principle 13: Processing space is limited, and gradually increases with age.

This operating principle reflects the complex of psychological problems dealing with such notions as "short-term memory," "operative memory," "computing space," "sentence-programming span," and the like. The operating principle has many important implications, as indicated by psycho-

---

6. This must be modified in light of the chimpanzee evidence noted earlier, and the possibility of future findings--at least in apes.

linguistic research of the past decade. Only a few of the most obvious are listed below.

Universal 13.1: There is a gradual increase in sentence length, including a two-morpheme stage.

Operating Principle 13 does not strictly require a two-morpheme stage, but it is reasonable to expect that the almost universally observed transition from a one-morpheme to a two-morpheme stage is based on a gradual increase in sentence-programming span.

Universal 13.2: At early stages of development, the presence of a negative element in a sentence is accompanied by decreased complexity of the rest of the sentence.

This phenomenon has been noted by Bellugi-Klima (1967), Bloom (1968), and others. For example, Bellugi-Klima has observed a stage in which question inversion is performed in affirmative questions but is lacking in negative questions (e.g. "Why are you going?" and "Why you aren't going?"). Bloom has noted subject deletion in early negative sentences (e.g. "This turn" but "No turn"), and gives other examples of decreased complexity in negative sentences (e.g. the following two sentences were both uttered when the child had no shoes on: "Kathryn have a socks on" and "Kathryn no shoe"). Bloom suggests further that negation engenders deletion of more recently acquired structures (cf. Universal 15.1).

Universal 13.3: In the course of development there is an increase in structures which require operations on more than one underlying string. (In other words, the number of possible Ss in the base structure of sentences increases with age.)

Numerous examples are available in the development of relative clauses and complement constructions. Collapsing several sentences into one requires increased operative memory--both to keep the subparts of the sentence appropriately connected and to keep the relevant rules available.

Operating Principle 13 is intimately related to principles stated earlier. In a sense, Operating Principle 12 (sentence integrity) can be considered a a consequence of Operating Principle 13 as applied to the realm of language

processing. Universal 9.1 (overgeneralization of rules) is also a consequence of Operating Principle 13. Indeed, Operating Principle 13 may give rise to another linguistic operating principle: Less processing space is required to apply a rule than to block the application of a rule and call up an exception[7].

Several of the operating principles considered thus far result in the following general prediction:

> Universal 13.4: Linguistic means for expressing semantic notions emerge in the following developmental order: (1) intonation, (2) word order, (3) addition of morphemes to words and sentences (e.g. inflections, question negative elements), (4) positioning of morphemes inside of sentences, (5) permutation of morphemes, (6) sentence embedding (right or left embedding preceding nesting).

The processing variables considered thus far deal with the pressures of ongoing linguistic computation during communicative acts. Although the question of short-term vs. long-term memory is a vexed one in psychology, some distinction must be drawn between the storage of the linguistic system and its use in ongoing communication. Clearly there is some sort of long-term storage which develops both in terms of capacity and organization. The most general and vague operating principle would state that:

> Operating Principle 14: Storage capacity increases with age.

This is obviously unsatisfactory because it assumes "storage capacity" to be a single entity, while the child succeeds in storing thousands of vocabulary items before he succeeds in storing a small number of rules or a small list of exceptions to given rules. It is not only capacity which develops, but some kind of organization--no doubt intimately connected to many aspects of cognitive growth.

---

7. It is possible that this operating principle is limited to speech production. We have no evidence of the comprehension of exceptions and irregularities, and they may well be understood before they are part of the child's active speech system. The entire problem of productive vs. receptive processing is in need of much analysis.

One feature of storage organization is reflected in accessibility--i. e. ease of access to stored material. Exceptions to rules may fail to be called up in production because they are inaccessible to the demands of speaking, rather than simply not present in storage. An operating principle in regard to accessibility might state:

> Operating Principle 15: The longer something has been stored and used, the more accessible it is for use in speech production.

A resulting universal would be pertinent to Lois Bloom's finding, mentioned above, that negation engenders deletion of more recently acquired structures:

> Universal 15. 1: It is categories which have been most recently acquired which tend to be deleted from speech under the pressure of performance limitations.

The operating principles and universals presented here are still in a tentative and preliminary stage of development. Some of them appear obvious until one considers the behavior and capacities of non-human species. Others are fairly specific and amenable to cross-linguistic investigation. It is hoped that the general framework will stimulate further development and investigation of these ideas.

REFERENCES

Bellugi [-Klima], Ursula. The acquisition of negation. Unpubl. doct. dissert., Harvard Univer., 1967.

Bloom, Lois M. Language development: Form and function in emerging grammars. Unpubl. doct. dissert., Columbia Univer., 1968. (MIT Press, in press.)

Chomsky, Carol S. The acquisition of syntax in children from five to ten. Unpubl. doct. dissert., Harvard Univer., 1968.

Clark, Eve V. How children describe time and order. In W. Weksel and T. G. Bever (Eds.), The structure and psychology of language. Vol. 2. New York: Holt, Rinehart and Winston, 1970 (in press).

Cromer, R. F. The development of temporal reference during the acquisition of language. Unpubl. doct. dissert., Harvard Univer., 1968.

Fillmore, C. J. The case for case. In E. Bach and R. T. Harms (Eds.), Universals in linguistic theory. New York: Holt, Rinehart and Winston, 1968.

Fraser, C., Bellugi, Ursula, and Brown, R. Control of grammar in imiation, comprehension, and production. J. verb. Learn. verb. Behav., 1963, 2, 121-135.

Furth, H. G. Piaget and knowledge. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

Gardner, R. A., and Gardner, Beatrice T. Teaching sign language to a chimpanzee. Science, 1969, 165, 664-672.

Gvozdev, A. N. Formirovaniye u rebenka grammaticheskogo stroya russkogo yazyka. Moscow: Akad. Pedag. Nauk RSFSR, 1949.

Ingram, D. Transitivity in child language. Unpubl. ms., Stanford Univer., 1969.

Leont'yev, A. A. Slovo v rechevoy deyatel'nosti. Moscow: Nauka, 1965.

McNeill, D., and McNeill, Nobuko B. What does a child mean when he says "no"? In H. Zale (Ed.), Proceedings of the conference on language and language behavior. New York: Appleton-Century-Crofts, 1968.

Menyuk, Paula. Sentences children use. Cambridge, Mass.: MIT Press, 1968.

Mikeš, Melanie. Acquisition des catégoires grammaticales dans le langage de l'enfant. Enfance, 1967, 3-4, 289-298.

Miller, W., and Ervin-Tripp, Susan M. Development of grammar in child language. In preparation.

Roeper, T. Observations and reflections on the acquisition of German. Unpubl. ms., Harvard Univer., 1969.

Slobin, Dan I. The acquisition of Russian as a native language. In F. Smith and G. A. Miller (Eds.), The genesis of language. Cambridge, Mass.: M.I.T. Press, 1966(a).

Slobin, Dan I. Discussion of "developmental psycholinguistics" by David McNeill. If F. Smith and G. A. Miller (Eds.), The genesis of language. Cambridge, Mass.: M.I.T. Press, 1966(b).

Slobin, Dan I. Early grammatical development in several languages, with special attention to Soviet research. In W. Weksel and T. G. Bever (Eds.), The structure and psychology of language. Vol. 2. New York: Holt, Rinehart and Winston, 1970(a) (in press). [Working Paper No. 11, Language-Behavior Research Laboratory, University of California, Berkeley, July 1968.]

Slobin, Dan I. Universals of grammatical development in children. In G. B. Flores d'Arcais and W. Levelt (Eds.), Advances in psycholinguistic research. The Hague: North Holland Publishing Co., 1970(b) (in press). [Working Paper No. 22, Language-Behavior Research Laboratory, University of California, Berkeley, September 1969.]